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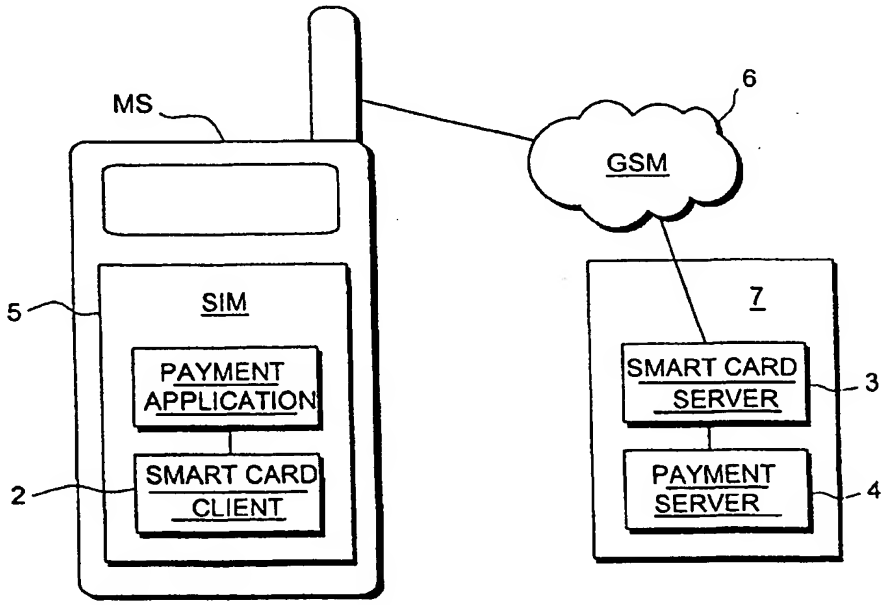
(57) Abstract

The invention concerns a method and system for the transmission of payment messages in a system comprising a smart card (5), a payment application (1) placed on the smart card (5), a telecommunication connection (6) and a payment server (4) disposed in a telecommunication network (7) and connected to the payment application (1). In the method, a smart card client (2) is disposed on the smart card (5), the payment application (1) is connected to the smart card client (2), a smart card server (3) is provided in the telecommunication network (7), the payment server (4) is connected to the smart card server (3) and the smart card client (2) is connected to the smart card server (3) via the telecommunication connection (6). The system of the invention comprises a smart card client (2) disposed on the smart card (5) and connected to the payment application (1), and a smart card server (3) disposed in the telecommunication network (7) and connected both to the payment server (4) and via the telecommunication connection (6) to the smart card client (2). The invention is used to optimize the exchange of messages between the payment application (1) and the payment server (4) in a manner appropriate for a mobile communication system.



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METHOD AND SYSTEM FOR THE TRANSMISSION OF MESSAGES

The present invention relates to telecommunication systems. In particular, the invention concerns the transmission of payment messages between a client application and a server.

BACKGROUND OF THE INVENTION

In prior art, payment systems are known in which e.g. a mobile station can be used to remit payments. Most payment applications have been basically designed for an environment where the number of payment messages to be exchanged does not significantly hamper the operation of the application. This means that the transmission path is a linear and short connection, e.g. like the contact between a smart card and a card reader, so the number of messages or the transmission speed does not constitute a problem. From the user's point of view, the transactions are executed at a sufficient speed.

For instance, an electronic purse called Set-Purse, implemented on the subscriber identity module (SIM) of a mobile station, uses a corresponding method of exchange of information as when a purse is used with a fixed smart card reader. In a mobile station application, the payment messages have to cross a wireless interface, which constitutes an insecurity factor in the transmission path. Especially when short messages are used, the response time in payment transactions may become annoyingly long for the user.

In addition, a payment system implemented on a smart card may be dependent on the supplier of the smart card. This is a problem for the mobile telephone operator because the payment system provided by the operator is dependent on another party.

The object of the present invention is to eliminate or at least to significantly reduce the

problems described above. A specific object of the invention is to disclose a new type of method and system for optimizing the exchange of messages between a payment application and a payment server.

BRIEF DESCRIPTION OF THE INVENTION

The invention concerns a method for the transmission of payment messages in a telecommunication system comprising a smart card, a payment application disposed on the smart card, a telecommunication connection and a payment server placed in a telecommunication network and connected to the payment application via the telecommunication connection. In the method of the invention, a smart card client is placed on the smart card. The payment application is connected to the smart card client. The telecommunication network is provided with a smart card server. The payment server is connected to the smart card server and the smart card client is connected to the smart card server via the telecommunication connection. The smart card is e.g. a SIM card connected to a mobile station and the telecommunication connection is implemented as a wireless connection established via a GSM (Global System for Mobile communications) or other network.

In a preferred embodiment of the invention, a new type of interface formed between the payment application and the payment server is used to optimize the number of messages crossing the radio interface. In an embodiment, the optimization is performed by the smart card client, and the message to be transmitted from the payment application to the payment server is stored on the smart card client and a message composed of one or more messages is sent to the smart card server. In a preferred case, a suitable response message is sent from the smart card client to the payment application. The response message may be produced in the form of a message sent by the payment server. Op-

tionally, the response message is generated on the basis of a message received by the smart card client from the smart card server.

Corresponding optimization can also be implemented with the smart card server. Preferably, both the smart card client and the smart card server participate in the optimization, in which case a new type of interface is formed between the payment application and the payment server, an interface which, in a preferred embodiment, crosses a wireless connection. In this case, a message to be transmitted from the payment server to the payment application is stored on the smart card server and a message composed of one or more messages is sent to the smart card client. In an embodiment, a response message is sent by the smart card server to the payment server. In an embodiment, the response message is generated in the form of a message sent by the payment application. In an embodiment, the response message is generated on the basis of a message received by the smart card server from the smart card client.

In an embodiment of the method, the serviceability of the connection both between the payment server and the payment application and between the smart card server and the smart card client is ensured by starting the transmission of payment messages as communication between the payment server and the payment application. After this, the transmission of payment messages is continued by transmitting the messages via the smart card client and the smart card server.

The telecommunication connection to be used in the invention can be selected from several different alternatives, e.g. depending on which alternative is the most appropriate one for the situation. One or more telecommunication connections may be applied in the invention, for example a telecommunication connec-

tion based on short messages or on the USSD (Unstructured Supplementary Service Data), WAP (Wireless Application Protocol) or GPRS (General Packet Radio Service) protocol.

The invention also concerns a system for the transmission of payment messages in a telecommunication system as described above. The system of the invention comprises a smart card client disposed on a smart card and connected to a payment application, a smart card server disposed in a telecommunication network and connected to a payment server, and a telecommunication connection connecting the smart card client to the smart card server.

In a preferred embodiment of the invention, the system comprises means for optimizing the exchange of payment messages between the payment server and the payment application. The optimization reduces the number of messages transmitted over the telecommunication connection, thus saving radio interface capacity.

The smart card client according to an embodiment of the invention comprises means for storing a message to be transmitted from the payment application to the payment server and means for sending a message composed of one or more messages to the smart card server. The smart card client preferably comprises means for sending a response message to the payment application. In an embodiment, the smart card client comprises means for generating a response message in the form of a message sent by the payment server. In an embodiment, the smart card client comprises means for generating a response message on the basis of a message received from the smart card server.

The smart card server according to an embodiment of the invention comprises means for storing a message to be transmitted from the payment server to the payment application and means for sending a message composed of one or more messages to the smart

card client. The smart card server preferably comprises means for sending a response message to the payment server. In an embodiment, the smart card server comprises means for generating a response message in the form of a message sent by the payment application.

In an embodiment of the invention, the system comprises means for starting the transmission of payment messages as communication between the payment server and the payment application and means for continuing the transmission of payment messages so that the messages are transmitted via the smart card client and the smart card server, thus ensuring that the connection is serviceable.

In an embodiment, the smart card server comprises means for generating a response message on the basis of a message received from the smart card client. The telecommunication connection to be used in the system may consist of one or more alternatives selected from the following set: short message, USSD protocol, WAP protocol or GPRS protocol.

The advantages of the invention include the fact that it reduces the exchange of messages in a payment situation. This results in considerable advantages in saving capacity especially as regards crossing of the radio interface. The invention also reduces the response times during the payment situation. Using a separate interface makes it possible to ensure that the payment databases are not visible to outsiders, thus improving data security. From the operator's point of view, the invention reduces the dependency on the smart card supplier, who may have their own manufacturer-specific protocol for the exchange of payment messages. The invention makes it possible to establish interfaces to many different payment systems, thus increasing the number of alternatives. Moreover, the security of the payment transaction is improved as fewer

messages are transmitted over an insecure radio interface.

LIST OF ILLUSTRATIONS

In the following, the invention will be described by the aid of a few examples of its embodiments with reference to the attached drawing, wherein:

Fig. 1 is a diagrammatic representation of a system according to the invention; and

Fig. 2 presents a diagrammatic example of a signalling scheme according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

The attached drawing presents the components of the system of the invention in a diagrammatic form. A payment application 1 and a smart card client 2 are disposed on a smart card 5, which is e.g. a SIM card as used in a mobile communication system. The smart card 5 is connected to a telecommunication terminal MS, which is e.g. a mobile station consistent with the GSM system. The terminal MS is connected via a telecommunication connection 6 to a smart card server 3. The telecommunication connection 6 is e.g. a digital mobile telephone connection based on the GSM system. The telecommunication connection 6 may be implemented e.g. using short messages, messages consistent with the USSD or WAP protocol or combinations of such messages. This description does not cover all the components needed for the establishment of the telecommunication connection 6 as they are obvious to the skilled person.

The smart card server 3 and the payment server 4 are disposed in a telecommunication network 7. 'Telecommunication network' refers to a combination of transmission paths and nodes forming connections between two or more points for telecommunication. The

telecommunication network may be e.g. a body consisting of a single component or it may be a completely distributed system with the smart card server 3 and payment server 4 disposed in physically separate components. The smart card server 3 is so connected to the payment server 4 that payment messages from the payment application 1 to the payment server 4 are transmitted via the smart card server 3 and the smart card client 2. In an embodiment of the invention, the connection can also be established without the smart card client 2 and the smart card server 3.

In the example, the smart card client 2 is implemented as software on the SIM card, so the means comprised in the smart card client are also implemented as software. 'Storing means' refers to a property of the smart card client 2 for storing information on the SIM card. Using sending means, the smart card client 2 transfers information either to the payment application 1 or to the telecommunication terminal MS, in which case the terminal implements the further transmission of the information to the smart card server 3.

The smart card server 3 and the means comprised in it are implemented e.g. as software in a network component managed by the operator. The payment server 4 can be implemented either in the same network component or in a separate component, in which case a separate telecommunication connection is established between the payment server 4 and the smart card server 3.

Fig. 2 presents an example of a signalling scheme according to the invention. The example represents the implementation of a payment transaction in conjunction with a SetPurse type smart card purse. In this case, both the payment application 1 and the payment server 4 correspond to prior-art components of the SetPurse payment application.

In a situation as encountered in prior-art solutions, the payment application 1 sends to the smart card client 2 a START message, represented by arrow number 21, intended for the payment server 4. (In the description below, the arrow corresponding to the message is referred to by the number only.) The message comprises the following information elements: ID, a code identifying the payment application; BALANCE, the money comprised in the payment application; SUM, the amount to be used; and NRO, the number of the transaction. The smart card client 2 stores the message 21 and sends to the payment application 1 an acknowledgement message REPLY 22, which comprises: CHALLENGE, a debiting command; MAC, a message authentication code; and CHARGECMD, message identifier. In a situation according to prior art, message 22 corresponds to a response message sent by the payment application 4. The smart card client 2 generates the response message without the radio interface of the telecommunication connection 6 being crossed.

The smart card client 2 generates from messages 21 and 22 a message 23, DEBITING, to be sent to the smart card server 3. This message 23 comprises the ID, BALANCE, SUM and NRO elements presented in message 21 as well as the MAC element presented in message 22. The smart card server 3 stores the message 23 and sends a DEBITING message 24 corresponding to message 21 to the payment server 4. The payment server 4 answers the message as in prior art with a REPLY message 25 resembling message 22. In message 25, the CHALLENGE, MAC and CHARGECMD information elements may differ from those included in message 22, in which case the smart card server 3 and the smart card client 2 perform a conversion of the corresponding identifiers. The smart card server 3 sends to the smart card client 2 an acknowledgement message 26, RECEIPT, which com-

prises the information elements CHALLENGE and MAC corresponding to message 25 as well as BALANCE.

The payment application 1 sends to the smart card client 2 a message 27, DEBITING, which comprises the information elements BALANCE, MAC and CHARGED, i.e. the amount payable by the payment application. After corresponding conversions, the message 27 is transmitted to the payment server 4. The payment server 4 sends an acknowledgement message RECEIPT 28 to the smart card server 3. Similarly, the smart card client 2 sends an acknowledgement message RECEIPT 29 to the payment application 1. The operation of the acknowledgement messages 28 and 29 can be secured e.g. by having the smart card client 2 wait for a predetermined length of time before sending the message 29. If the smart card server 3 does not receive an acknowledgement message 28 of the right type from the payment server, then it will send an error message to the smart card client 2.

To make sure that the connection between different components is serviceable, it is possible to establish a connection between the payment application 1 and the payment server 4 without the smart card client 2 and the smart card server 3 at the beginning of the payment transaction. This feature can be utilized e.g. in failure diagnosis.

The invention is not restricted to the examples of its embodiments described above, but many variations are possible within the scope of the inventive idea defined in the claims.

CLAIMS

1. Method for the transmission of payment messages in a system comprising:

a smart card (5);

a payment application (1) placed on the smart card (5);

a telecommunication connection (6);

a telecommunication network (7); and

a payment server (4) is disposed in the telecommunication network (7) and connected to the payment application (1) via a telecommunication connection (6), characterized in that the method comprises the following steps:

a smart card client (2) is disposed on the smart card (5);

the payment application (1) is connected to the smart card client (2);

a smart card server (3) is provided in the telecommunication network (7);

the payment server (4) is connected to the smart card server (3); and

the smart card client (2) is connected to the smart card server (3) via the telecommunication connection (6).

2. System as defined in claim 1, characterized in that the exchange of payment messages between the payment application (1) and the payment server (4) over the interface between the smart card client (2) and the smart card server (3) is optimized.

3. Method as defined in claim 2, characterized in that the method comprises the following steps:

a message to be transmitted from the payment application (1) to the payment server (4) is stored in the smart card client (2); and

a message composed of one or more messages is sent to the smart card server (3).

4. Method as defined in claim 3, characterized in that the method comprises a step wherein a response message is sent from the smart card client (2) to the payment application (1).

5. Method as defined in claim 4, characterized in that the method comprises a step wherein the response message is generated in the form of a message sent by the payment server (4).

6. Method as defined in claim 4 or 5, characterized in that the method comprises a step wherein the response message is generated on the basis of a message received by the smart card client (2) from the smart card server (3).

7. Method as defined in claim 2, characterized in that the method comprises the following steps:

a message to be transmitted from the payment server (4) to the payment application (1) is stored on the smart card server (3); and

a message composed of one or more messages is sent to the smart card client (2).

8. Method as defined in claim 7, characterized in that the method comprises a step wherein a response message is sent to the payment server (4) by the smart card server (3).

9. Method as defined in claim 8, characterized in that the method comprises a step wherein the response message is generated in the form of a message sent by the payment application (1).

10. Method as defined in claim 8 or 9, characterized in that the method comprises a step wherein the response message is generated on the basis of a message received by the smart card server (3) from the smart card client (2).

11. Method as defined in claim 1, characterized in that the serviceability of the connection is ensured by:

starting the transmission of payment messages as communication between the payment server (4) and the payment application (1); and

continuing the transmission of payment messages so that the messages are transmitted via the smart card client (2) and the smart card server (3).

12. Method as defined in claim 1, characterized in that the telecommunication connection (6) is implemented using short messages.

13. Method as defined in claim 1, characterized in that the telecommunication connection (6) is implemented using the USSD protocol.

14. Method as defined in claim 1, characterized in that the telecommunication connection (6) is implemented using the WAP protocol.

15. Method as defined in claim 1, characterized in that the telecommunication connection (6) is implemented using the GPRS protocol.

16. System for the transmission of payment messages, comprising:

a smart card (5);

a payment application (1) disposed on the smart card (5);

a telecommunication connection (6);

a telecommunication network (7); and

a payment server (4) disposed in the telecommunication network (7) and connected to the payment application (1) via the telecommunication connection (6), characterized in that the system comprises:

a smart card client (2) disposed on the smart card (5) and connected to the payment application (1); and

a smart card server (3) disposed in the telecommunication network (7) and connected both to the payment

server (4) and via the telecommunication connection (6) to the smart card client (2).

17. System as defined in claim 16, characterized in that the system comprises means for optimizing the exchange of payment messages between the payment server (4) and the payment application (1).

18. System as defined in claim 17, characterized in that the smart card client (2) comprises:

means for storing a message to be transmitted from the payment application (1) to the payment server (4); and

means for sending a message composed of one or more messages to the smart card server (3).

19. System as defined in claim 18, characterized in that the smart card client (2) comprises means for sending a response message to the payment application (1).

20. System as defined in claim 19, characterized in that the smart card client (2) comprises means for generating the response message in the form of a message sent by the payment server (4).

21. System as defined in claim 19 or 20, characterized in that the smart card client (2) comprises means for generating the response message on the basis of a message received from the smart card server (3).

22. System as defined in claim 17, characterized in that the smart card server (3) comprises:

means for storing a message to be transmitted from the payment server to the payment application; and

means for sending a message composed of one or more messages to the smart card client (2).

23. System as defined in claim 22, characterized in that the smart card server (3)

comprises means for sending a response message to the payment server (4).

24. System as defined in claim 23, characterized in that the smart card server (3) comprises means for generating the response message in the form of a message sent by the payment application (1).

25. System as defined in claim 22 or 23, characterized in that the smart card server (3) comprises means for generating the response message on the basis of a message received from the smart card client (2).

26. System as defined in claim 16, characterized in that the system comprises:

means for starting the transmission of payment messages as communication between the payment server (4) and the payment application (1); and

means for continuing the transmission of payment messages so that the messages are transmitted via the smart card client (2) and the smart card server (3), thus ensuring the serviceability of the circuit.

27. System as defined in claim 16, characterized in that the telecommunication connection (6) is implemented using short messages.

28. System as defined in claim 16, characterized in that the telecommunication connection (6) is implemented using the USSD protocol.

29. System as defined in claim 16, characterized in that the telecommunication connection (6) is implemented using the WAP protocol.

30. System as defined in claim 16, characterized in that the telecommunication connection (6) is implemented using the GPRS protocol.

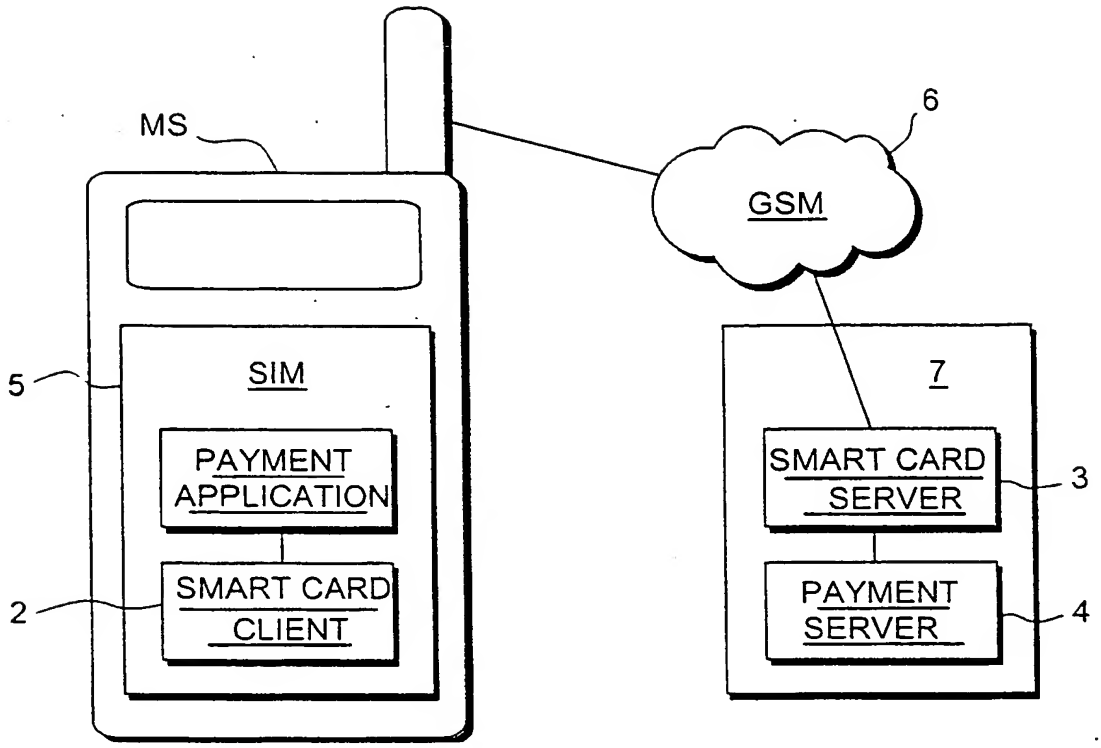
MS
6
GSM
SIM
5
PAYMENT APPLICATION
SMART CARD CLIENT
2
7
SMART CARD SERVER
3
PAYMENT SERVER
4

Fig. 1

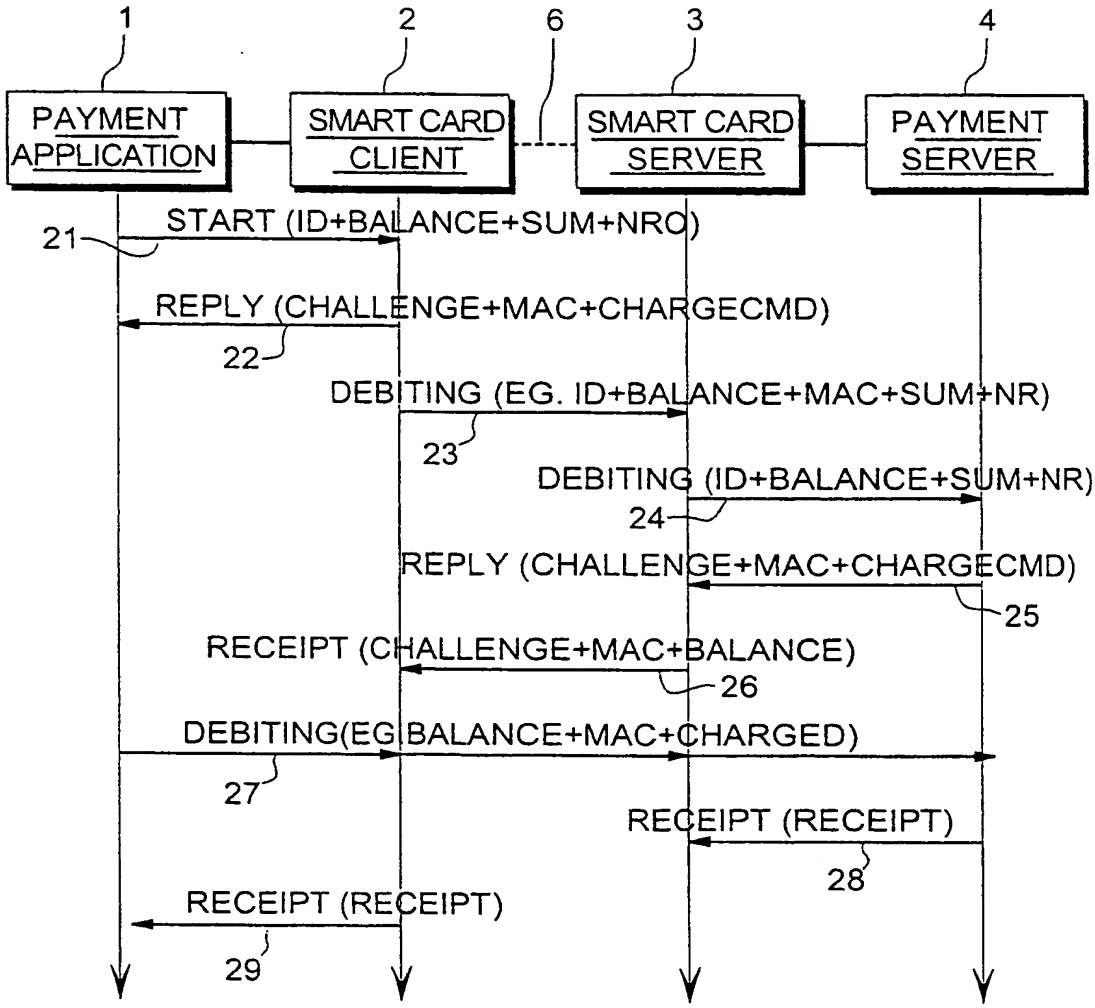

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00072

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G07F 19/00, G07F 7/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9849658 A1 (VISA INTERNATIONAL SERVICE ASSOCIATION), 5 November 1998 (05.11.98), page 11, line 12 - line 19; page 11, line 26 - page 12, line 2; page 15, line 10 - line 24, figures 4,5, 11A-11C, abstract, page 20, line 34 - page 21, line 23 --	1-30
X	WO 9852151 A1 (ACCESS SECURITY SWEDEN AB), 19 November 1998 (19.11.98), page 12, line 33 - page 13, line 6; page 14, line 1 - line 19, figures 3,5, claims 1-6,10,14 --	1-3,7,11-18, 22,26-30

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 April 2000	03 -05- 2000
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00072

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

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